

WHAT IS CLAIMED IS:

1. A disk storage system comprising:
  - a first plurality of disk drives storing data;
  - a second plurality of disk drives storing data;
  - a first loop used to transfer data to the first disk drives;
  - a second loop used to transfer data to the second disk drives;
  - a first plurality of communicating lines connecting the first loop and the second loop;
  - a second plurality of communicating lines connecting the first loop and the second loop;
  - a first plurality of connecting parts connecting the first communication lines and the second communication lines with the first disk drives;
  - a second plurality of connecting parts connecting the first communicating lines and the second communicating lines with the second disk drives;
  - a disk controller comprising:
    - a first disk communicating port connected to the first loop, and communicating with the first disk drives via the first loop,
    - a second disk communicating port connected to the second loop, and communicating with the second disk drives via the second loop,
    - a host communicating port communicating with a host unit,
    - a cache memory storing data communicating between the host communication port and the first and the second disk communicating ports, and
    - a processor controlling the host communicating port, the first disk communicating port, the second disk communicating port and the cache memory.

2. A disk storage system according to claim 1, wherein each of the first plurality of connecting parts connecting each of the first and the second plurality of communicating lines with each of the first plurality of disk drives, and each of the second plurality of connecting parts connecting each of the first and the second plurality of communicating lines with each of the second plurality of disk drives.

3. A disk storage system according to claim 2, wherein each of the first plurality of communicating lines corresponding to the first plurality of disk drives are normal communication route, and each of the second plurality of communicating lines corresponding to the first plurality of disk drives are communication route in case of a failure of each of the first plurality of communicating lines.

4. A disk storage system according to claim 3, wherein each of the first plurality of communicating lines corresponding to the first plurality of disk drives are normal communication route, and each of the second plurality of communicating lines corresponding to the first plurality of disk drives are communication route in case of a failure of the first loop.

5. A disk storage system according to claim 4, wherein each of the first plurality of communicating lines communicate with each of the first plurality of disk drives via each of the first plurality of connecting parts in usual, however some of the first plurality of communicating lines is changed to some of the

second plurality of communicating lines when a failure happen in some of the first plurality of communicating lines, and some of the second plurality of communicating lines communicate with some of the first plurality of disk drives via some of the first plurality of connecting parts.

6. A disk storage system according to claim 5, wherein each of the first plurality of communicating lines communicate with each of the first plurality of disk drives via each of the first plurality of connecting parts in usual, however some of the first plurality of communicating lines is changed to some of the second plurality of communicating lines when a failure happen in the first loop, and some of the second plurality of communicating lines communicate with some of the first plurality of disk drives via some of the first plurality of connecting parts.

7. A disk storage system according to claim 6, wherein each of the second plurality of communicating lines corresponding to the second plurality of disk drives are normal communication route, and each of the first plurality of communicating lines corresponding to the second plurality of disk drives are communication route in case of a failure of each of the second plurality of communicating lines.

8. A disk storage system according to claim 7, wherein each of the second plurality of communicating lines corresponding to the second plurality of disk drives are normal communication route, and each of the first plurality of

communicating lines corresponding to the second plurality of disk drives are communication route in case of a failure of the second loop.

9. A disk storage system according to claim 8, wherein each of the second plurality of communicating lines communicate with each of the second plurality of disk drives via each of the second plurality of connecting parts in usual, however some of the second plurality of communicating lines is changed to some of the first plurality of communicating lines when a failure happen in some of the second plurality of communicating lines, and some of the first plurality of communicating lines communicate with some of the second plurality of disk drives via some of the second plurality of connecting parts.

10. A disk storage system according to claim 9, wherein each of the second plurality of communicating lines communicate with each of the second plurality of disk drives via each of the second plurality of connecting parts in usual, however some of the second plurality of communicating lines is changed to some of the first plurality of communicating lines when a failure happen in the second loop, and some of the first plurality of communicating lines communicate with some of the second plurality of disk drives via some of the second plurality of connecting parts.

11. A disk storage system according to claim 1, wherein some of the first plurality of connecting parts connect one of the first plurality of communicating lines, and some of the second plurality of connecting parts connect one of the second plurality of communicating lines.

12. A disk storage system according to claim 11, wherein each of the first plurality of communicating lines corresponding to the first plurality of disk drives are normal communication route, and each of the second plurality of communicating lines corresponding to the first plurality of disk drives are communication route in case of a failure of each of the first plurality of communicating lines.

13. A disk storage system according to claim 12, wherein each of the first plurality of communicating lines corresponding to the first plurality of disk drives are normal communication route, and each of the second plurality of communicating lines corresponding to the first plurality of disk drives are communication route in case of a failure of the first loop.

14. A disk storage system according to claim 13, wherein each of the first plurality of communicating lines communicate with each of the first plurality of disk drives via each of the first plurality of connecting parts in usual, however some of the first plurality of communicating lines is changed to some of the second plurality of communicating lines when a failure happen in some of the first plurality of communicating lines, and some of the second plurality of communicating lines communicate with some of the first plurality of disk drives via some of the first plurality of connecting parts.

15. A disk storage system according to claim 14, wherein each of the first plurality of communicating lines communicate with each of the first plurality

of disk drives via each of the first plurality of connecting parts in usual, however some of the first plurality of communicating lines is changed to some of the second plurality of communicating lines when a failure happen in the first loop, and some of the second plurality of communicating lines communicate with some of the first plurality of disk drives via some of the first plurality of connecting parts.

16. A disk storage system according to claim 15, wherein each of the second plurality of communicating lines corresponding to the second plurality of disk drives are normal communication route, and each of the first plurality of communicating lines corresponding to the second plurality of disk drives are communication route in case of a failure of each of the second plurality of communicating lines.

17. A disk storage system according to claim 16, wherein each of the second plurality of communicating lines corresponding to the second plurality of disk drives are normal communication route, and each of the first plurality of communicating lines corresponding to the second plurality of disk drives are communication route in case of a failure of the second loop.

18. A disk storage system according to claim 17, wherein each of the second plurality of communicating lines communicate with each of the second plurality of disk drives via each of the second plurality of connecting parts in usual, however some of the second plurality of communicating lines is changed to some of the first plurality of communicating lines when a failure happen in

some of the second plurality of communicating lines, and some of the first plurality of communicating lines communicate with some of the second plurality of disk drives via some of the second plurality of connecting parts.

19. A disk storage system according to claim 18, wherein each of the second plurality of communicating lines communicate with each of the second plurality of disk drives via each of the second plurality of connecting parts in usual, however some of the second plurality of communicating lines is changed to some of the first plurality of communicating lines when a failure happen in the second loop, and some of the first plurality of communicating lines communicate with some of the second plurality of disk drives via some of the second plurality of connecting parts.

20. A disk storage system according to claim 1, wherein the first plurality of communicating lines corresponding to the first plurality of disk drives are normal communication route, and some of the second plurality of communicating lines corresponding some of to the first plurality of disk drives are communication route in case of a failure of some of the first plurality of communicating lines.

21. A disk storage system according to claim 20, wherein the second plurality of communicating lines corresponding to the second plurality of disk drives are normal communication route, and some of the first plurality of communicating lines corresponding to some of the second plurality of disk drives

are communication route in case of a failure of some of the second plurality of communicating lines.

22. A disk storage system according to claim 1, wherein the first plurality of communicating lines corresponding to the first plurality of disk drives are normal communication route, and the second plurality of communicating lines corresponding to the first plurality of disk drives are communication route in case of a failure of the first loop.

23. A disk storage system according to claim 22, wherein the second plurality of communicating lines corresponding to the second plurality of disk drives are normal communication route, and the first plurality of communicating lines corresponding to the second plurality of disk drives are communication route in case of a failure of the second loop.

24. A disk storage system according to claim 1, wherein the first plurality of communicating lines communicate with the first plurality of disk drives via the first plurality of connecting parts in usual, however some of the first plurality of communicating lines is changed to some of the second plurality of communicating lines when a failure happen in some of the first plurality of communicating lines, and some of the second plurality of communicating lines communicate with some of the first plurality of disk drives via some of the first plurality of connecting parts.



25. A disk storage system according to claim 24, wherein the second plurality of communicating lines communicate with the second plurality of disk drives via the second plurality of connecting parts in usual, however some of the second plurality of communicating lines is changed to some of the first plurality of communicating lines when a failure happen in some of the second plurality of communicating lines, and some of the first plurality of communicating lines communicate with some of the second plurality of disk drives via some of the second plurality of connecting parts.

26. A disk storage system according to claim 1, wherein the first plurality of communicating lines communicate with the first plurality of disk drives via the first plurality of connecting parts in usual, however the first plurality of communicating lines is changed to the second plurality of communicating lines when a failure happen in the first loop, and the second plurality of communicating lines communicate with the first plurality of disk drives via the first plurality of connecting parts.

27. A disk storage system according to claim 26, wherein the second plurality of communicating lines communicate with the second plurality of disk drives via the second plurality of connecting parts in usual, however the second plurality of communicating lines is changed to the first plurality of communicating lines when a failure happen in the second loop, and the first plurality of communicating lines communicate with the second plurality of disk drives via the second plurality of connecting parts.